APPENDICES

A

APPENDIX A

Electronic Database for Chemicals of Concern Detected in Soil and Groundwater

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27 September 2002

To Potential Users of Electronic Files:

Erler & Kalinowski, Inc. ("EKI") has provided our CLIENT, the Oakland Base Reuse Authority ("OBRA"), with paper copies of the *Final Remedial Action Plan, Oakland Army Base, Oakland, California,* that includes the *Final Risk Management Plan as Appendix E*, dated 27 September 2002, prepared by EKI. An electronic copy of the chemical information database (Appendix A to the RAP, i.e., the COC Database) used to prepare these documents is provided on this compact disk. Information contained in the database was received from the Army contractor and others and has not been verified for completeness or accuracy by EKI.

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If you have any questions or require additional information, please call me at (650) 292-9100.

Very truly yours,

ERLER & KALINOWSKI, INC.

Thomas W. Kalinowski

Thomas W. Kalinowski, Sc.D.
Vice President

A10063.00

B

APPENDIX B

Sample Calculations and Model Outputs Supporting Determination of Remediation Goals

LeadSpread Version 7.0
Computer Spreadsheets

BLOOD LEAD CONCENTRATION FOR EXPOSURE OF CONSTRUCTION/INDUSTRIAL WORKERS TO LEAD IN SOIL AT PROPOSED CLEANUP LEVEL

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	**3,500**
Lead in Water (ug/l)	15.0
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1.5

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	4.3	7.9	9.4	11.4	13.0	2417	3809
BLOOD Pb, CHILD	26.4	48.2	57.0	69.3	78.9	255	435
BLOOD Pb, PICA CHILD	51.0	93.2	110.3	134.0	152.5	128	219
BLOOD Pb, OCCUPATIONAL	3.4	6.1	7.3	8.8	**10.0**	3475	5464

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	7	
Days per week, occupational		**5**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area occupational	cm^2	2900	
Soil adherence	ug/cm^2	70	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	1575.0	

Click here for REFERENCES

PATHWAYS

ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.13	3%	1.4E-5	0.05	1%
Soil Ingestion	8.8E-4	3.08	71%	6.3E-4	2.20	65%
Inhalation, bkgrnd		0.05	1%		0.03	1%
Inhalation	2.5E-6	0.01	0%	1.8E-6	0.01	0%
Water Ingestion		0.84	19%		0.84	25%
Food Ingestion, bkgrnd		0.23	5%		0.23	7%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.19	1%		0.19	0%
Soil Ingestion	7.0E-3	24.64	93%	1.4E-2	49.28	97%
Inhalation	2.0E-6	0.01	0%		0.01	0%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	4%		0.96	2%
Food Ingestion, bkgrnd		0.54	2%		0.54	1%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

BLOOD LEAD CONCENTRATION FOR EXPOSURE OF MAINTENANCE WORKERS TO LEAD IN SOIL AT PROPOSED CLEANUP LEVEL

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	**77,000**
Lead in Water (ug/l)	15.0
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	1.5

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	72.0	131.6	155.7	189.2	215.3	2417	3809
BLOOD Pb, CHILD	548.1	1001.2	1184.6	1439.8	1638.4	255	435
BLOOD Pb, PICA CHILD	1090.1	1991.4	2356.3	2863.8	3259.0	128	219
BLOOD Pb, OCCUPATIONAL	3.4	6.1	7.3	8.8	**10.0**	76604	119842

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	7	
Days per week, occupational *		**0.23**	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area occupational	cm^2	2900	
Soil adherence	ug/cm^2	70	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.082	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	34650.0	

Click here for REFERENCES

PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	2.95	4%	6.4E-7	0.05	1%
Soil Ingestion	8.8E-4	67.76	94%	2.9E-5	2.23	66%
Inhalation, bkgrnd		0.05	0%		0.00	0%
Inhalation	2.5E-6	0.19	0%	8.1E-8	0.01	0%
Water Ingestion		0.84	1%		0.84	25%
Food Ingestion, bkgrnd		0.23	0%		0.23	7%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	4.29	1%		4.29	0%
Soil Ingestion	7.0E-3	542.08	99%	1.4E-2	1084.16	99%
Inhalation	2.0E-6	0.15	0%		0.15	0%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	0%		0.96	0%
Food Ingestion, bkgrnd		0.54	0%		0.54	0%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

* Equivalent to 12 days per year

Johnson and Ettinger Model Version 2.3
Computer Spreadsheets

Soil Remedial Goals for Indoor Worker

DATA ENTRY SHEET FOR J&E MODEL

SL-ADV
Version 2.3; 03/01

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
75014		Vinyl chloride (chloroethene)

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER (Totals must add up to value of L_t (cell D28)) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	15	15	150	15	0	0			1.00E-08

ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
1.704	0.357	0.196	0.026	0	0	0	0	0	0	0	0

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)
15	40	6000	6000	488	0.1	1

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

Soil Remedial Goals for Indoor Worker

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.04E-01	9.80E-06	2.71E-02	25	5,250	259.25	432.00	2.45E+00	2.76E+03	3.9E-05	2.0E-01	G

END

Soil Remedial Goals for Indoor Worker

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	**Initial soil concentration used, C_R (μg/kg)**	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	1	0.161	0.000	0.000	#N/A	#N/A	#N/A	1.00E-08	24,000	**1.00E+00**	4.88E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
3.60E+07	6.67E-05	15	4,944	2.03E-02	8.58E-01	1.77E-04	1.86E-03	0.00E+00	0.00E+00	1.86E-03	1	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	**Finite source β term (unitless)**	**Finite source ψ term $(sec)^{-1}$**	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
6.38E-02	3.30E+03	0.10	5.98E+01	1.86E-03	2.40E+03	1.02E+87	NA	NA	**1.12E+03**	**3.61E-03**	**4.45E+07**	**YES**

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	**Mass limit** bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	2.15E-03	NA	2.15E-03	3.9E-05	2.0E-01

END

Soil Remedial Goals for Indoor Worker

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
4.92E+01	1.38E+05	4.92E+01	7.17E+05	4.92E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 2.3; 03/01

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial groundwater conc., C_W (μg/L)	Chemical
75014		Vinyl chloride (chloroethene)

MORE ↓

ENTER Average soil/groundwater temperature, T_S (°C)	**ENTER** Depth below grade to bottom of enclosed space floor, L_F (cm)	**ENTER** Depth below grade to water table, L_{WT} (cm)	**ENTER** Totals must add up to value of L_{WT} (cell D28) Thickness of soil stratum A, h_A (cm)	**ENTER** Thickness of soil stratum B, (Enter value or 0) h_B (cm)	**ENTER** Thickness of soil stratum C, (Enter value or 0) h_C (cm)	**ENTER** Soil stratum directly above water table, (Enter A, B, or C)	**ENTER** SCS soil type directly above water table	**ENTER** Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined stratum A soil vapor permeability, k_v (cm^2)
15	15	150	150	0	0	A	S			1.00E-08

MORE ↓

ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Stratum A soil total porosity, n^A (unitless)	**ENTER** Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	**ENTER** Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	**ENTER** Stratum B soil total porosity, n^B (unitless)	**ENTER** Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	**ENTER** Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	**ENTER** Stratum C soil total porosity, n^C (unitless)	**ENTER** Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
1.704	0.357	0.196	0	0	0	0	0	0

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	**ENTER** Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	**ENTER** Enclosed space floor length, L_B (cm)	**ENTER** Enclosed space floor width, W_B (cm)	**ENTER** Enclosed space height, H_B (cm)	**ENTER** Floor-wall seam crack width, w (cm)	**ENTER** Indoor air exchange rate, ER (1/h)
15	40	6000	6000	488	0.1	1

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm{\cdot}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
1.04E-01	9.80E-06	2.71E-02	25	5,250	259.25	432.00	2.45E+00	2.67E+03	3.9E-05	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	135	0.161	0.000	0.000	#N/A	#N/A	#N/A	1.00E-08	17.05	0.357	0.035	0.322	24,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\cdot m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} ($g/cm\cdot s$)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
4.88E+06	3.60E+07	6.67E-05	15	4,944	2.03E-02	8.58E-01	1.77E-04	1.86E-03	0.00E+00	0.00E+00	1.36E-05	1.03E-04	135

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	8.58E+02	0.10	5.98E+01	1.86E-03	2.40E+03	1.02E+87	3.85E-06	3.30E-03	3.9E-05	1.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
3.17E+01	4.42E+04	3.17E+01	2.67E+06	3.17E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

C

APPENDIX C

Sensitivity Analysis of Risk-Based Remediation Goal Calculations

C-1. BARE DIRT INDUSTRIAL WORKER EXPOSURE SCENARIO

This appendix presents a sensitivity analysis of risk calculations for a hypothetical exposure pathway of an outdoor industrial worker scenario where no cover materials are assumed to exist on soils at the OARB (i.e., the "bare dirt" outdoor industrial worker scenario). The "bare dirt" outdoor industrial worker scenario assumes that workers are present for 25 years on the OARB with exposed surface soil and no cover materials, i.e., paving, foundations, imported landscaping soils, or gravel, to provide a barrier to direct contact or wind erosion of existing soil. This bare dirt scenario is not currently the case nor will be the case in the future at OARB under the planned commercial and industrial redevelopment, and is presented herein for informational purposes only.

Table C-1.1 presents individual COC remediation goals calculated as a sensitivity evaluation for the outdoor industrial worker for the hypothetical 25-year "bare dirt" exposure scenario. Table C-1.2 lists several key input parameters and assumptions used in the calculation of goals listed in Table C-1.1.

Under the hypothetical bare dirt scenario, all typical dirt contact, ingestion, and inhalation pathways are assumed to be complete. As shown in Table C-1.1, the resultant, calculated health-protective concentrations for many COCs under the bare dirt outdoor industrial worker scenario are more stringent than the remediation goals for the OARB described in Section 7.4 of the RAP, e.g., approximately one-third of the COCs are calculated to have lower goals in the bare dirt scenario and the calculated goals for remaining COCs are controlled by other exposure pathways addressed in Section 7 of the RAP. Risk-based numerical remediation goals calculated for the bare dirt industrial worker scenario are, thus, illustrative of the protective effects of incorporating required cover materials as part of all remedial actions for the OARB considered in this RAP. These hypothetical risk calculations also provide a gauge of the sensitivity of these risk evaluations to potential failures in the permanence or long-term effectiveness in a barrier-type remedy.

TABLE C-1.1
HYPOTHETICAL SITE-SPECIFIC RISK-BASED REMEDIATION GOALS CALCULATED FOR CHEMICALS OF CONCERN IN SOIL TO PROTECT OUTDOOR INDUSTRIAL WORKERS EXPOSED TO BARE DIRT FOR 25 YEARS (a)

Oakland Army Base, Oakland, California

Chemical of Concern	Estimated Soil Saturation Concentration (mg/kg) (b)	RG_{nc} Non-carcinogenic Remediation Goal at HI = 1 (mg/kg); (c)	RG_c Carcinogenic Remediation Goal at Risk = 10^{-6} (mg/kg); (c)	Lowest Remediation Goal to Protect Outdoor Commercial Worker (mg/kg); (d)
Metals				
Antimony	(e)	670	(f)	670
Arsenic	(e)	360	2.3	2.3
Barium	(e)	86,000	(f)	86,000
Beryllium	(e)	2,700	790	790
Cadmium	(e)	1,000	14	14
Chromium (III)	(e)	930,000	(f)	MAX(100,000); (m)
Chromium (VI)	(e)	2,600	6	6
Chromium, Total	(e)	18,000 (g)	42 (g)	42
Cobalt	(e)	100,000	(f)	100,000
Copper	(e)	62,000	(f)	62,000
Lead	--	--	--	3,500 (j)
Manganese	(e)	30,000	(f)	30,000
Mercury	(e)	140	(f)	140
Molybdenum	(e)	8,300	(f)	8,300
Nickel	(e)	33,000	7,300	7,300
Selenium	(e)	8,300	(f)	8,300
Silver	(e)	8,300	(f)	8,300
Thallium	(e)	120	(f)	120
Vanadium	(e)	12,000	(f)	12,000
Zinc	(e)	500,000	(f)	MAX(100,000)
Volatile Organic Compounds				
1,1,2,2-tetrachloroethane	7,000	15,000	3.1	3.1
1,1,2-trichloroethane	9,400	650	7.5	7.5
1,1-dichloroethane	5,900	8,300	30	30
1,1-dichloroethene	710	310	(f)	310
1,2,3-trichloropropane	3,600	1,700	(f)	1,700
1,2,4-trimethylbenzene	5,400	820	(f)	820
1,2-dichloroethane	8,100	140	3.5	3.5
1,3,5-trimethylbenzene	1,300	430	(f)	430
Benzene	3,000	100	1.7	1.7
Bromodichloromethane	7,900	2,100	2.2	2.2
Carbon tetrachloride	1,100	22	0.6	0.6
Chloroform	14,000	890	12	12
Dibromochloromethane	4,100	3,900	5.8	5.8
cis-1,2-dichloroethene	3,700	670	(f)	670
trans-1,2-dichloroethene	7,100	920	(f)	920

TABLE C-1.1
HYPOTHETICAL SITE-SPECIFIC RISK-BASED REMEDIATION GOALS CALCULATED FOR CHEMICALS OF CONCERN IN SOIL TO PROTECT OUTDOOR INDUSTRIAL WORKERS EXPOSED TO BARE DIRT FOR 25 YEARS (a)

Oakland Army Base, Oakland, California

Chemical of Concern	Estimated Soil Saturation Concentration (mg/kg) (b)	RG_{nc} Non-carcinogenic Remediation Goal at HI = 1 (mg/kg); (c)	RG_c Carcinogenic Remediation Goal at Risk = 10^{-6} (mg/kg); (c)	Lowest Remediation Goal to Protect Outdoor Commercial Worker (mg/kg); (d)
Volatile Organic Compounds				
Ethylbenzene	1,200	27,000	(f)	SAT(1,200); (i)
Isopropylbenzene (Cumene)	3,800	30,000	(f)	SAT(3,800)
Methyl tertiary butyl ether	21,000	89,000	160	160
Methylene chloride	5,800	21,000	34	34
n-propylbenzene	1,200	1,600	(f)	SAT(1,200)
p-cymene (p-isopropyltoluene)	3,700	30,000	(f)	SAT(3,700)
sec-butylbenzene	4,000	1,500	(f)	1,500
tert-butylbenzene	530	1,300	(f)	SAT(530)
Tetrachloroethene	2,200	1,100	12	12
Toluene	3,900	13,000	(f)	SAT(3,900)
Trichloroethene	3,000	450	20	20
Trichlorofluoromethane	4,300	24,000	(f)	SAT(4,300)
Vinyl chloride	670	290	0.1	0.1
Xylenes, Total	1,200	200,000	(f)	SAT(1,200)
Semi-volatile Organic Compounds				
Acenaphthene	(e)	30,000	(f)	30,000
Acenaphthylene	(e)	(i)	(f)	(k)
Anthracene	(e)	140,000	(f)	MAX(100,000)
Benzidine	(e)	1,400	0.003	0.003
Benzo(a)anthracene	(e)	(i)	1.1	1.1
Benzo(a)pyrene	(e)	(i)	0.1	0.1
Benzo(b)fluoranthene	(e)	(i)	1.1	1.1
Benzo(b,k)fluoranthene	(e)	(i)	1.1	1.1
Benzo(g,h,i)perylene	(e)	(i)	(f)	(k)
Benzo(l)fluoranthene	(e)	(i)	1.1	1.1
Bis(2-ethylhexyl)phthalate	100	12,000	568	SAT(100)
Chrysene	(e)	(i)	12	12
Dibenz(a,h)anthracene	(e)	(i)	0.3	0.3
Fluoranthene	(e)	18,000	(f)	18,000
Fluorene	(e)	18,000	(f)	18,000
Hexachlorobutadiene	83,000	170	21	21
Indeno(1,2,3-c,d)pyrene	(e)	(i)	1.1	1.1
Naphthalene	(e)	750	(f)	750
Phenanthrene	(e)	140,000	(f)	MAX(100,000)
Pyrene	(e)	14,000	(f)	14,000

TABLE C-1.1

HYPOTHETICAL SITE-SPECIFIC RISK-BASED REMEDIATION GOALS CALCULATED FOR CHEMICALS OF CONCERN IN SOIL TO PROTECT OUTDOOR INDUSTRIAL WORKERS EXPOSED TO BARE DIRT FOR 25 YEARS (a)

Oakland Army Base, Oakland, California

Chemical of Concern	Estimated Soil Saturation Concentration (mg/kg) (b)	RG_{nc} Non-carcinogenic Remediation Goal at HI = 1 (mg/kg); (c)	RG_c Carcinogenic Remediation Goal at Risk = 10^{-6} (mg/kg); (c)	Lowest Remediation Goal to Protect Outdoor Commercial Worker (mg/kg); (d)
Total Petroleum Hydrocarbons				
TPH Diesel`	--	--	--	(l)
TPH Gasoline	--	--	--	(l)
TPH Motor Oil	--	--	--	(l)
TPH Recoverable	--	--	--	(l)
PCBs, Pesticides, and Herbicides				
Aldrin	(e)	27	0.2	0.2
Alpha BHC	(e)	260	0.9	0.9
Alpha endosulfan (Endosulfan I)	(e)	4,500	(f)	4,500
Alpha chlordane	110	450	2	2
Gamma chlordane	110	450	2	2
Dieldrin	(e)	46	0.2	0.2
Endosulfan sulfate	(e)	4,900	(f)	4,900
Endrin	(e)	280	(f)	280
Endrin aldehyde	(e)	280	(f)	280
Endrin ketone	(e)	280	(f)	280
Gamma BHC (Lindane)	(e)	260	2.2	2.2
Heptachlor	(e)	400	0.6	0.6
Heptachlor epoxide	60	12	0.5	0.5
4,4'-DDD	(e)	470	11	11
4,4'-DDE	(e)	430	7	7
4,4'-DDT	(e)	470	8	8
PCB-1248 (Aroclor 1248)	570	(i)	0.3	0.3
PCB-1260 (Aroclor 1260)	(e)	(i)	0.3	0.3
Dioxins				
2,3,7,8-tetrachlorodibenzo-p-dioxin	(e)	(i)	0.00001	0.00001

TABLE C-1.1

HYPOTHETICAL SITE-SPECIFIC RISK-BASED REMEDIATION GOALS CALCULATED FOR CHEMICALS OF CONCERN IN SOIL TO PROTECT OUTDOOR INDUSTRIAL WORKERS EXPOSED TO BARE DIRT FOR 25 YEARS (a)

Oakland Army Base, Oakland, California

Notes:

(a) This table presents individual risk-based remediation goals calculated as a sensitivity evaluation for the outdoor industrial worker for the hypothetical 25-year "bare dirt" exposure scenario; other exposure scenarios may result in more stringent remeidation goals as listed in Table 7-11 in the main body of the RAP. See Table C-1.2 for a summary of key input values and exposure assumptions for the hypothetical 25-year "bare dirt" exposure scenario.

(b) Soil saturation concentration for COCs are calculated below using equation from U.S. EPA, 1 November 2000, *Region 9 Preliminary Remediation Goals (PRGs) 1999*, Memorandum from Stanford J. Smucker, Ph.D., Regional Toxicologist (SFD-8-B), Technical Support Team.

(c) Risk-based remediation goals assume a non-carcinogenic target risk level that corresponds to a hazard index of 1 and a carcinogenic target risk level of one-in-one million (i.e., 10^{-6}) incremental risk of an individual developing cancer over a lifetime from exposure to a single chemical.

(d) Unless otherwise noted, value cited is the lesser of the non-carcinogenic and carcinogenic risk-based remediation goals when both values could be calculated.

(e) No soil saturation concentrations were calculated for compounds that are solids under ambient temperature and pressure.

(f) U.S. EPA or OEHHA do not classify compound as a potential carcinogen, thus no published carcinogenic slope factor is available for this compound.

(g) Consistent with U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA, 2000), the remediation goal for total chromium was calculated from the chromium (III) and chromium (VI) remediation goal assuming a 1:6 ratio of chromium (VI) to chromium (III).

(h) Prefix "SAT" denotes risk -based value exceeds calculated soil saturation concentration, thus, the estimated saturation value is listed.

(i) No published chronic reference dose is available for this compound, and no suitable surrogate compound was identified.

(j) Risk-based remediation goal for lead calculated using DTSC Lead Spread Version 7.0 computer model (See Appendix B).

(k) No published human health toxicity values available for compound. Consequently, risk-based remediation goal could not be calculated for this compound.

(l) No site-specific risk-based remediation goals were calculated for petroleum hydrocarbons. Fuel Storage Tank Sites Cleanup Levels derived by the Army are adopted as remediation goals for petroleum hydrocarbons. Refer to Table 7-11.

(m) Prefix "MAX" denotes that the calculated risk-based concentration is 100,000 mg/kg or greater. A non-risk based "ceiling limit" concentration for metals and certain SVOCs that are solids at ambient temperatures is given as 100,000 mg/kg, consistent with U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA, 2000).

TABLE C-1.2
EXPOSURE PARAMETERS USED TO CALCULATE HUMAN HEALTH RISK-BASED REMEDIATION GOALS FOR THE HYPOTHETICAL "BARE DIRT" EXPOSURE SCENARIO

Oakland Army Base, Oakland, California

Parameter	Symbol	Unit	Value	Note/Reference
Averaging Time	AT			
Carcinogens		year	70	Default value (a)
Non-carcinogens		year	ED	Default value (a)
Body Weight	BW			
Outdoor industrial worker		kg	70	Default value (a)
Dermal Absorption Factor	ABS			
Arsenic			0.03	Default value (b)
Cadmium			0.001	Default value (b)
Other metals			0.01	Default value (c)
Chlordane			0.05	Specified by DTSC HERD
DDT			0.05	Specified by DTSC HERD
Other chlorinated pesticides			0.05	Specified by DTSC HERD
Benzo(a)pyrene			0.15	Specified by DTSC HERD
Other polycyclic aromatic hydrocarbons			0.15	Specified by DTSC HERD
Semi-volatile organic compounds			0.1	Default value (b)
Polychlorinated biphenyls			0.15	Specified by DTSC HERD
Volatile organic compounds			0.1	Default value (c)
Exposure Duration	ED			
Outdoor industrial worker		year	25	Default value (a)
Exposure Frequency	EF			
Outdoor industrial worker		day/year	250	Default value (a)
Exposure Interval	T			
Outdoor industrial worker		s	7.9×10^{8}	Calculated as 3.16×10^{7}*ED
Ingestion Rate for Soil	IR_{soil}			
Outdoor industrial worker		mg/day	50	Specified by DTSC HERD
Inhalation Rate for Air	IR_{air}			
Outdoor industrial worker		m^3/day	20	Default value (a)
Particulate Emission Factor	PEF			
Outdoor industrial worker		m^3/kg	4.63×10^{9}	Default value (a)

TABLE C-1.2
EXPOSURE PARAMETERS USED TO CALCULATE HUMAN HEALTH RISK-BASED REMEDIATION GOALS FOR THE HYPOTHETICAL "BARE DIRT" EXPOSURE SCENARIO

Oakland Army Base, Oakland, California

Parameter	Symbol	Unit	Value	Note/Reference
Skin Surface Area Exposed to Soil	SA			
Outdoor industrial worker		cm^2/day	5,700	(d)
Soil-to-Air Volatilization Factor	VF			
Outdoor industrial worker		m^3/kg		Chemical-specific value (g)
Soil-to-Skin Adherence Factor	AF			
Outdoor industrial worker		mg/cm^2	0.2	Default value for industrial worker (b)

Notes:

(a) U.S. EPA. 1991. *Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim.* Office of Solid Waste and Emergency Response. Publication: 9285.7-01B.

(b) U.S. EPA. September 2001. *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual – Part E (Supplemental Guidance for Dermal Risk Assessment), Interim*. Office of Solid Waste and Emergency Response.

(c) Cal-EPA. July 1992 (corrected and reprinted August 1996). *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities.*

(d) DTSC. 7 January 2000. Memorandum to Human and Ecological Risk Division. *Guidance for the Dermal Exposure Pathway*.

(g) Soil-to-air volatilization factor is chemical-specific. Volatilization factors were calculated using the equation in Section 3.3.1 in U.S. EPA's Risk Assessment Guidance for Superfund, Part B, dated December 1991, and input parameters listed in Table 7-4 of this RAP.

C-2. DERMAL CONTACT WITH COCs IN GROUNDWATER

This appendix presents a sensitivity analysis of risk calculations for hypothetical dermal contact with COCs in groundwater. Under planned redevelopment, future on-site commercial and industrial workers will have no contact with groundwater; however, such contact may occur on a short-term basis and intermittently during dewatering or trenching activities by earthwork construction workers and future maintenance personnel, e.g., when penetrating cover materials and digging deeper than approximately 5-feet, bgs. Hypothetical remediation goals that would be protective for earthwork construction workers and maintenance personnel from dermal exposure to vinyl chloride, benzo(a)pyrene, or arsenic in shallow groundwater were calculated using the equations and exposure factors in *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) – Interim* (U.S. EPA, 2001). These three exemplar COCs were selected because they represent three broad classes of COCs possibly occurring on-site at OARB (VOCs, SVOCs, and metals) and their relatively high potency as possible carcinogens. The assumed exposure duration for these sensitivity calculations was 1-year with an exposure frequency of 10 days per year, an event frequency of 1 per day, and an event duration of 8 hours.

Hypothetical exposures by contact with COCs in groundwater are judged to be insignificant for the following reasons: (a) the OBRA COC analytical data base and the recent Phase II data collected by the Army and OBRA indicate that chemical impacts to groundwater are limited to only a few well-defined areas of the shallow water-bearing zone (i.e., identified groundwater RAP sites) that will be remediated as part of the RAP, and (b) workers will not be exposed to COCs in groundwater because appropriate health and safety requirements will be incorporated into on-site activities that may involve incidental contact with contaminated groundwater, consistent with protocols in Section 6.1 of the RMP.

VINYL CHLORIDE IN GROUNDWATER

Vinyl chloride is present in groundwater at the OARB in three well-defined areas, as described in Section 4 of the main body of the RAP. As shown on the attached calculation worksheet, the hypothetical remediation goal to protect the earthwork construction worker from dermal exposure to vinyl chloride in groundwater at a cancer risk of 10^{-6} is estimated to be 5,400 μg/L. This indicates that the hypothetical risk to earthwork construction workers from dermal contact with vinyl chloride in groundwater is insignificant when this concentration is compared to the remediation goal, as presented in Section 7.4 of the RAP, to protect indoor commercial workers from inhalation of vapors (32 µg/L), which will govern future remediation of vinyl chloride impacts to shallow groundwater at the OARB. Thus, hypothetical, incidental dermal contact to vinyl chloride in groundwater is judged to be insignificant and unlikely, particularly in the vast majority of the OARB outside of the groundwater RAP sites.

BENZO(A)PYRENE IN GROUNDWATER

Similarly, as shown on the attached calculation worksheet, the hypothetical remediation goal to protect the earthwork construction worker from dermal exposure to benzo(a)pyrene in groundwater at a cancer risk of 10^{-6} is estimated to be 0.3 µg/L. This concentration of benzo(a)pyrene compared to concentrations measured in a few samples of groundwater at the OARB indicates that the hypothetical risk to earthwork construction workers could be significant if earthwork construction workers contacted benzo(a)pyrene impacted groundwater at the OARB. However, contact with benzo(a)pyrene in groundwater is unlikely as it was detected in groundwater in only 11 of the 418 groundwater samples collected at the OARB, and the majority of these benzo(a)pyrene detections were groundwater samples collected during underground storage tank removal actions. Additionally, these reported concentrations of benzo(a)pyrene at the OARB were close to, or even greater than, the solubility of benzo(a)pyrene in groundwater, which is approximately 1.6 µg/L. This indicates that such groundwater samples were likely turbid or contained petroleum residuals, and the benzo(a)pyrene was actually present on the soil particles or in the petroleum residual, and not dissolved in groundwater. Thus, risks of dermal contact with benzo(a)pyrene in groundwater is judged to be insignificant and unlikely, particularly in the vast majority of the OARB outside of the former tank locations.

ARSENIC IN GROUNDWATER

Similarly, as shown on the attached calculation worksheet, the hypothetical remediation goal to protect the earthwork construction worker from dermal exposure to arsenic in groundwater at a cancer risk of 10^{-6} is estimated to be 2,600 µg/L. The maximum concentration of arsenic measured in groundwater at the OARB during the recent Phase II investigations was 43 µg/L, indicating that the hypothetical risk to earthwork construction workers from dermal contact to arsenic in groundwater is insignificant.

Vinyl chloride

Cancer Risk = Slope Factor ("SF") x Dermal Absorbed Dose ("DAD")

Cancer Risk = 1.8E-10 for 1 ug/L in groundwater - see calculations below

Remediation goal to protect against dermal exposure at 10-6

$\boxed{5{,}400 \quad \text{ug/L}}$

SF = 0.27 (mg/kg-day)-1

equation (1) from U.S. EPA (2001)

DAD = (Daevent x EV x ED x EF x SA)/ (BW x AT)

DAD = 6.8E-10 mg/kg - day (see inputs below)

where:

BW	70	body weight (kg)
SA	5,700	exposed skin surface area (cm2)
ED	1	exposure duration (years)
EV	1	event frequency (events/day)
EF	10	exposure frequency (days/year) - best professional judgement
ATnc	365	averaging time for non-carcinogens (days)
ATc	25550	averaging time for carcinogens (days)
DAevent	2.1E-08	dermal absorbed dose per event (chemical specific -see equation 2)

equation (2) from U.S. EPA (2001)

DAevent = 2 x FA x Kp x CW x sqrt (6 tauevent x tevent/pi)

DAevent = 2.1E-08 mg/cm2- event (see inputs below)

where:

FA	1	fraction absorbed water - from Appendix B of U.S. EPA, 2001
Kp	5.60E-03	permeability coefficient (cm/hr) - from Appendix B of U.S. EPA, 2001)
Cw	0.000001	concentration in water (mg/cm3) (= 1 ug/L)
τevent	0.24	lag time per event (hours/event) - from Appendix B
tevent	8	event duration (hours/event) - best professional judgement
t*	0.57	time to reach steady state (hours) - from Appendix B
B	0	dimensionless ratio for permeability - from Appendix B

Benzo(a)pyrene

Cancer Risk = Slope Factor ("SF") x Dermal Absorbed Dose ("DAD")

Cancer Risk = 3.4E-06 for 1 ug/L in groundwater - see calculations below

Remediation goal to protect against dermal exposure at 10-6

0.3	ug/L

SF = 12 (mg/kg-day)-1

equation (1) from U.S. EPA (2001)
DAD = (Daevent x EV x ED x EF x SA)/ (BW x AT)

DAD = 2.9E-07 mg/kg - day (see inputs below)

where:

BW	70	body weight (kg)
SA	5,700	exposed skin surface area (cm2)
ED	1	exposure duration (years)
EV	1	event frequency (events/day)
EF	10	exposure frequency (days/year) - best professional judgement
ATnc	365	averaging time for non-carcinogens (days)
ATc	25550	averaging time for carcinogens (days)
DAevent	9.0E-06	dermal absorbed dose per event (chemical specific -see equation 2)

equation (2) from U.S. EPA (2001)

DAevent = 2 x FA x Kp x CW x sqrt (6 tauevent x tevent/pi)

DAevent = 9.0E-06 mg/cm2- event (see inputs below)

where:

FA	1	fraction absorbed water - from Appendix B of U.S. EPA, 2001
Kp	7.00E-01	permeability coefficient (cm/hr) - from Appendix B of U.S. EPA, 2001)
Cw	0.000001	concentration in water (mg/cm3) (= 1 ug/L)
τevent	2.69	lag time per event (hours/event) - from Appendix B
tevent	8	event duration (hours/event) - best professional judgement
t*	11.67	time to reach steady state (hours) - from Appendix B
B	4.3	dimensionless ratio for permeability - from Appendix B

Arsenic

Cancer Risk = Slope Factor ("SF") x Dermal Absorbed Dose ("DAD")

Cancer Risk = 3.8E-10 for 1 ug/L in groundwater - see calculations below

Remediation goal to protect against dermal exposure at 10-6

2,600	ug/L

SF = 1.5 (mg/kg-day)-1

equation (1) from U.S. EPA (2001)
DAD = (Daevent x EV x ED x EF x SA)/ (BW x AT)

DAD = 2.5E-10 mg/kg - day (see inputs below)

where:

BW	70	body weight (kg)
SA	5,700	exposed skin surface area (cm2)
ED	1	exposure duration (years)
EV	1	event frequency (events/day)
EF	10	exposure frequency (days/year) - best professional judgement
ATnc	365	averaging time for non-carcinogens (days)
ATc	25550	averaging time for carcinogens (days)
DAevent	8.0E-09	dermal absorbed dose per event (chemical specific -see equation 2)

equation (2) from U.S. EPA (2001)

DAevent = Kp x CW x tevent

DAevent = 8.0E-09 mg/cm2- event (see inputs below)

where:

Kp	1.00E-03	permeability coefficient (cm/hr) - from Appendix B of U.S. EPA, 2001)
Cw	0.000001	concentration in water (mg/cm3) (= 1 ug/L)
tevent	8	event duration (hours/event) - best professional judgement

C-3. JOHNSON AND ETTINGER CALCULATIONS FOR LOW VOLATILITY COCs

This appendix presents a sensitivity risk analysis of hypothetical remediation goal calculations for relatively low or non-volatile COCs using the advanced U.S. EPA version of the Johnson and Ettinger Model (U.S. EPA, 2001). This analysis was conducted for polychlorinated biphenyls ("PCBs"), aldrin, alpha BHC, and gamma BHC (lindane). The calculations of risk-based remediation goals for these compounds in soil were performed using the same exposure pathway parameters and inputs listed in Section 7.4 of the RAP. The results of these calculations are shown below.

The hypothetical remediation goals for these low volatility compounds in soil, as determined using the Johnson and Ettinger and input parameters specific to the OARB are as follows:

PCBs: 3,460 mg/kg (greater than solubility)

Aldrin: 4,240 mg/kg

Alpha-BHC: 212 mg/kg (greater than solubility)

Gamma-BHC: 343 mg/kg (greater than solubility)

The corresponding goals calculated for these same COCs in Table 7-11 are at least two orders of magnitude lower than the hypothetical goals above, indicating that for these non-volatile compounds, the indoor air exposure pathway is insignificant compared to other exposure pathways when remediated to the goals in Table 7-11 or found at concentrations below those goals. Thus, such calculations were not routinely performed for other low volatility organics. As discussed in the main text the RAP, when such organic COCs are found at elevated concentrations or as free phase products, it will be appropriate to consider the volatilization pathway in determining potential health risks, although other remediation goals are likely to control final remediation objectives.

D

APPENDIX D

Interim Use Sites

D. INTERIM USE SITES

Brief descriptions of buildings at the OARB that have current, interim uses for temporary residential, school or childcare uses are provided in this appendix. These four interim use sites or buildings are located in the area of OARB south of 14th Street. As shown on historical aerial photographs of the OARB just prior to development by the Army in 1941, this area of the OARB was bare ground still reflecting the apparent contouring of the hydraulic filling or other filling operations. Thus, there is no apparent prior industrial use of these interim use sites at OARB before the Army development after 1941. Figures are provided in this appendix for each interim use building described below. Current tenants at the four interim use sites or buildings may continue to occupy the sites and buildings for five years post-transfer upon DTSC's issuance of waivers for such specified sensitive reuses.

Analytical data from investigations conducted at or near these interim use sites, e.g., for sample locations indicated on the figures in this appendix, are available in the electronic database in Appendix A of this RAP, as well as data obtained from OBRA's Phase II report entitled *OBRA Phase II Investigation Data Report, Oakland, California* (EKI, 2002), and the Army's Phase II report entitled *Draft Phase II Supplemental Investigation Report, Oakland, California* (IT, 2002). The results of Phase II investigations conducted at or near these interim use sites are briefly summarized below where relevant.

BUILDING 796

Building 796 is a former Army barracks and administration building, which is now used as part of the OAKLAND MILITARY INSTITUTE (NATIONAL GUARD COLLEGE PREPARATORY ACADEMY). The school includes several temporary classroom units located on asphalt on the adjacent parking area. The OMI is a Charter School facility established in partnership with the California National Guard and the Mayor of Oakland for students in grades 7-12. There are currently 160 7th-grade students enrolled in the 2001-2002 school year, and plans are to enroll 160 additional 8th-grade students in the school year beginning September 2002. The school is supported by a total of 25 to 40 teachers and administrators.

As part of its Phase II investigation, OBRA collected three surface soil samples around Building 796 and analyzed the samples for lead. Lead concentrations in these samples varied from 57 mg/kg to 140 mg/kg. As reported in the PA/SI, there is one pad-mounted or vaulted dry transformer at Building 796 (Kleinfelder, 1998b).

BUILDING 740

Building 740, a former bowling alley, is home to OPERATION DIGNITY, a 100-bed winter emergency relief shelter for homeless men and women. The site is leased to the City of Oakland Community and Economic Development Agency, who funds the program. The program operates from January 15 through the end of April, and is open from 6:00 p.m. until 8:00 a.m. the following morning. Clients are transported to the shelter by a free van, which picks up and drops off from designated sites in Berkeley and Oakland.

Building 740 was constructed in 1968. No surface soil sample was collected to assess the potential of lead contamination from exterior surfaces painted with lead-based paint.

As reported in the PA / SI, one pad-mounted PCB-containing transformer at Building 740 was tested by the Army, and PCBs were not detected above analytical laboratory reporting limits (Kleinfelder, 1998b).

Tank D site is located adjacent to the west side of Building 740. Tank D was a 1,000-gallon fuel oil UST. The Army removed Tank D in 1990, removed floating product in 1994 and 1995, and excavated contaminated soil in 1994 and 2000. RWQCB requires periodic groundwater monitoring for TPH-d, TPH-mo, and PAHs at existing wells to confirm that floating product has been removed.

BUILDING 655

Building 655, built in 1987, is a former Army childcare center, which is still used as such. Known formally as the CITY OF OAKLAND LIFE ENRICHMENT AGENCY, AGING, HEALTH & HUMAN SERVICES HEAD START PROGRAM, the Child Development Program provides education, nutrition, health, and mental services to low-income children and families throughout Oakland. The program operates Monday through Friday, from 7:00 a.m. to 6:00 p.m., and is staffed by 10-12 full-time employees serving 85 to 91 children (60 families).

Former Building T-661, located in the footprint of Building 655, was designated as "hostess house" (Post Map, Oakland Army Base, dated 28 May 1943 (Revised 16 December 1947), Office of the Post Engineer), and later converted into a "bachelor officers' quarters" and a "transient quarters" (General Site and Building Use Map, 5 August 1960). Former Building T-661 was constructed in 1942 and was demolished sometime after 1960. No surface soil sample was collected at the former Building T-661 perimeter to assess the potential of lead contamination. The building perimeter coincides with the childcare center's playground area.

According to a property card for Building T-661 on file at the Oakland Army Base, dated 29 June 1948, Building T-661 was heated with an oil-fired furnace. A drawing entitled "General Heating Plan", sheet 9 of 16, dated 14 May 1963 shows a 1,000-gallon underground heating oil storage tank located near former Building T-661. No records were reviewed by EKI or the Port indicating that the tank was removed.

The Army did not investigate the possible location of the heating tank near former Building T-661. The possible tank location is directly beneath Building 655, which apparently was not easily accessible to a drill rig or geophysical investigation by the Army.

BUILDING 650

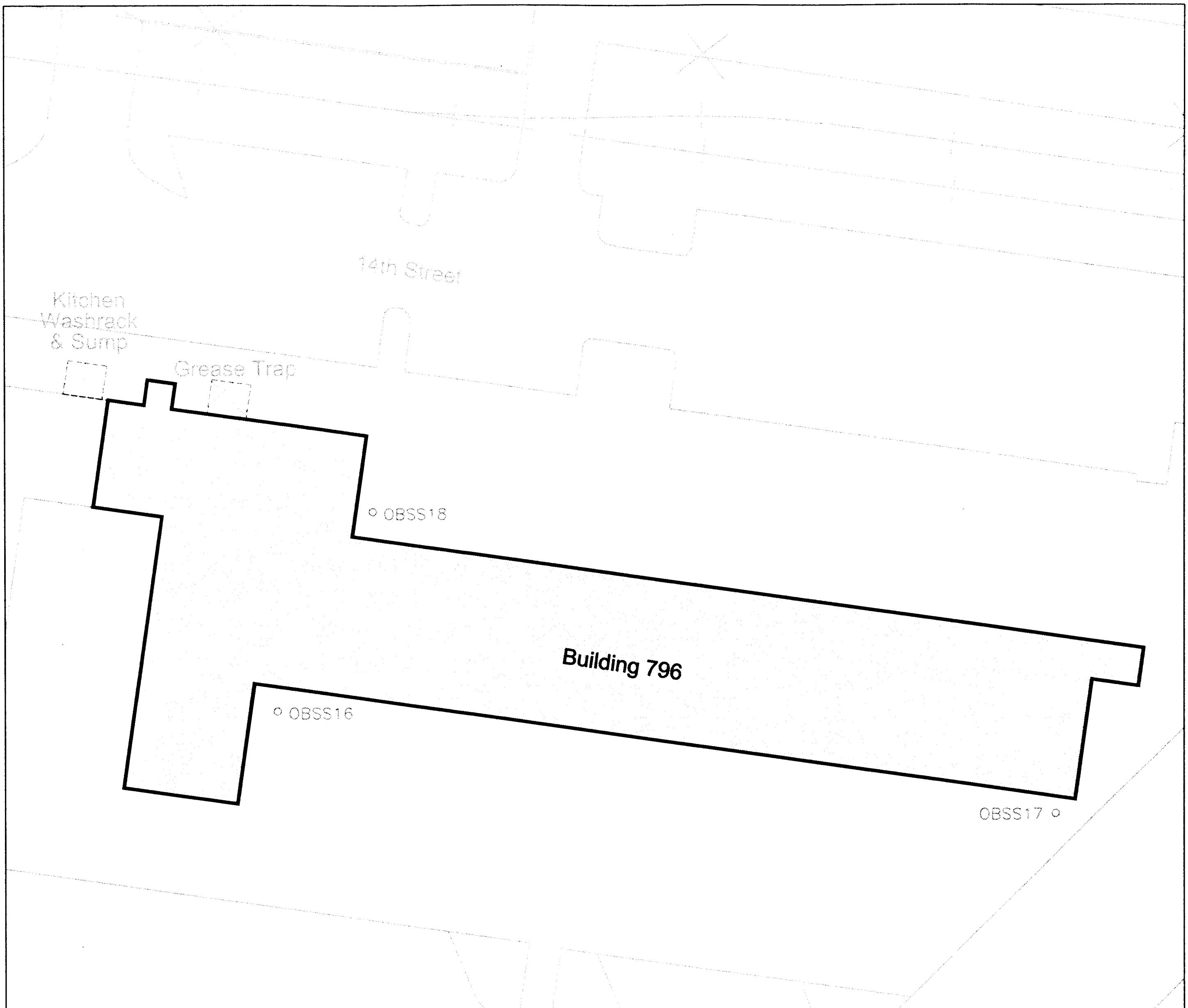
Building 650 is a former Army guest house in which MILESTONES HUMAN SERVICES, INC., through its Milestones-East Bay Center program, operates a licensed residential drug and alcohol treatment facility for homeless men and women in Building 650 under a contract the California Department of Corrections. Occupying the first floor of Building 650 (also known as Jacobs Guest House), the program offers a comprehensive set of services ranging from substance abuse treatment, literacy and education, life skills, employment preparation, placement, counseling, and aftercare services. There are nine full-time staff members for a resident population of 25. The program operates 24 hours per day, 7 days a week.

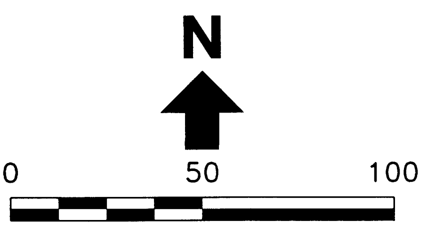
Former Buildings S-651 and S-654, located in the footprint of Building 650, were designated by the Office of the Post Engineer at Oakland Army Base as "bachelor officers' quarters" and "post office", respectively (Post Map, Oakland Army Base, dated 28 May 1943 (Revised 16 December 1947), Office of the Post Engineer; General Site and Building Use Map, 5 August 1960). Former Buildings S-651 and S-654 were constructed in 1942 and were demolished sometime after 1966.

According to the property card for Building S-651 on file at the Oakland Army Base, dated 21 April 1948, Building S-651 was heated with an oil-fired furnace. A drawing entitled "General Heating Plan", sheet 9 of 16, dated 14 May 1963 shows a 500-gallon underground heating oil storage tank located near former Building S-651. No records were reviewed by EKI or the Port indicating that the tank was removed.

As part of its Phase II Investigation, the Army advanced two soil borings in the possible location of the 500-gallon former heating oil tank near former Building S-651. No petroleum hydrocarbons or volatile organic compounds were detected in soil above analytical method reporting limits. Low concentrations of 1,2,4-trimethylbenzene (0.26 µg/L), ethylbenzene (0.31 µg/L), xylenes (0.31 µg/L), toluene (0.21 µg/L), and diesel (130 µg/L) were detected in a grab groundwater sample from one of the borings. The Army also constructed monitoring well ITMW249 near Building 650 to the West. No organic COCs were detected in soil sampled from this well boring above analytical method reporting limits. No metals were detected in soil at concentrations above residential PRGs. Low concentrations of ethylbenzene (0.46 µg/L), xylenes (0.52 µg/L), toluene (0.25 µg/L) and diesel (200µg/L) were detected in groundwater collected from the monitoring well.

As part of its Phase II Investigation, OBRA collected four surface soil samples around Building 650 and analyzed the samples for lead. Lead concentrations in these samples ranged from 22 mg/kg to 460 mg/kg.





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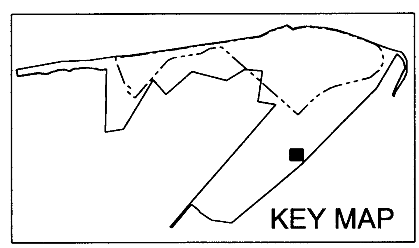


EXPLANATION:

Footprint of Former Building or Feature

Soil Sample

Erler & Kalinowski, Inc.

Building 796 Area

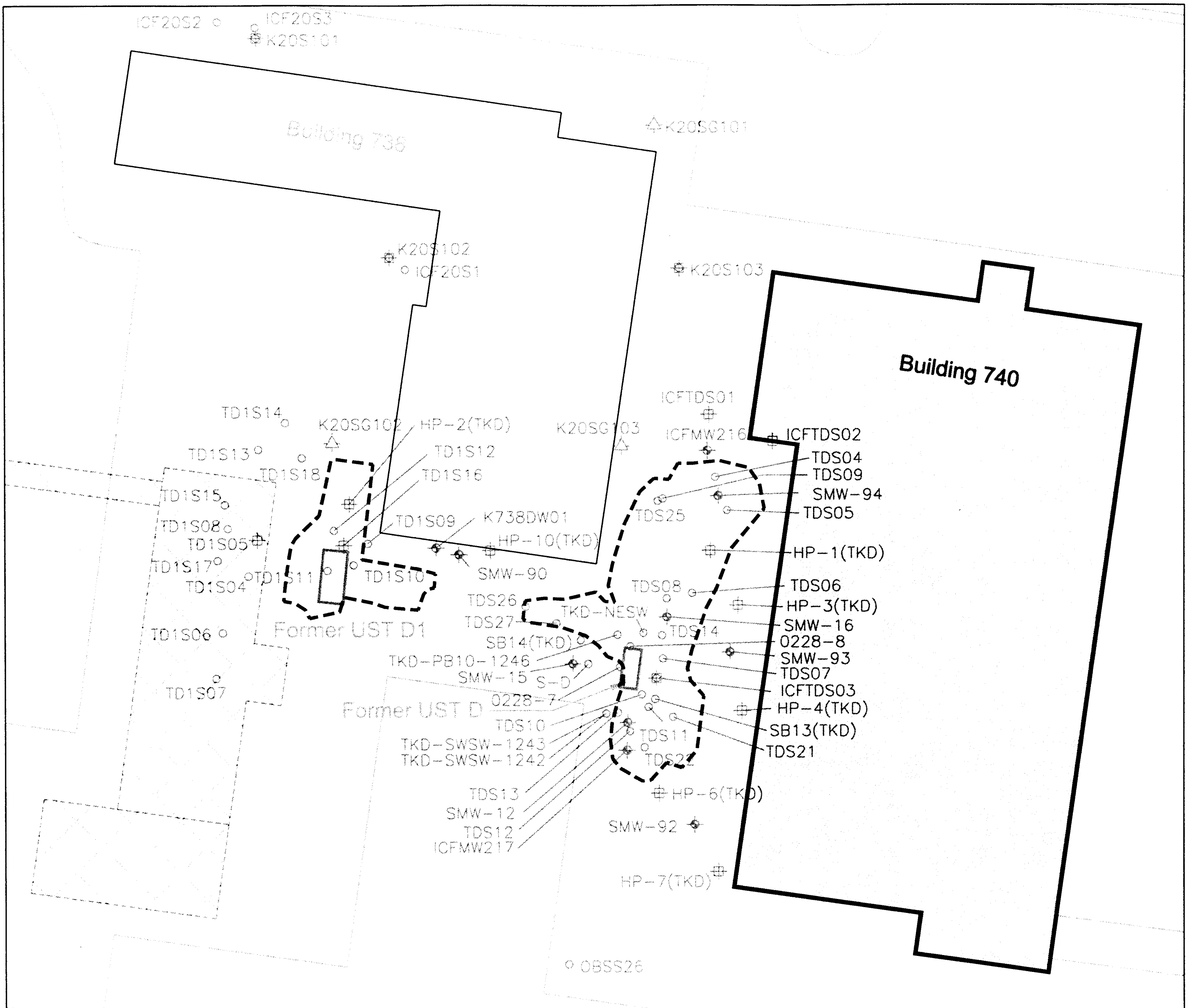
Oakland Army Base
Oakland, CA

September 2002
EKI A10063.00

Figure D-1

Notes:

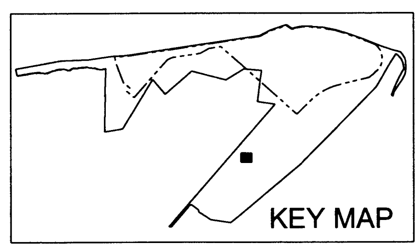
1. All locations are approximate.
2. Basemap taken from IT Corporation "OARB Site Map", dated 17 February 1999.



N

0 40 80

(Approximate Scale in Feet)



EXPLANATION:

- Footprint of Former Building or Feature
- Approximate Limit of Excavation Boundary
- Monitoring Well
- Grab Groundwater Sample
- Soil Sample
- Soil and Grab Groundwater Sample

Notes:

1. All locations are approximate.
2. Basemap taken from IT Corporation "OARB Site Map", dated 17 February 1999.

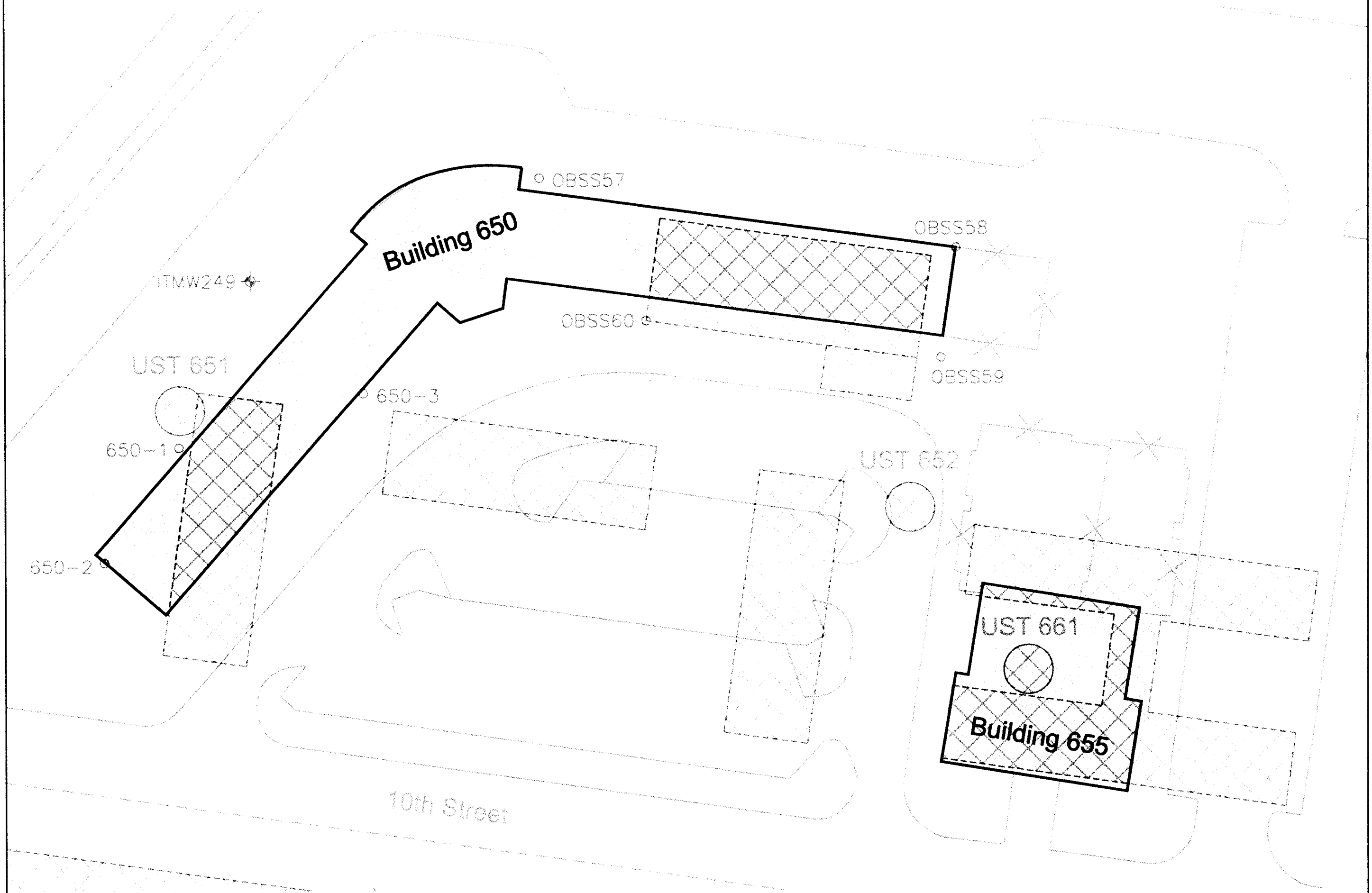
Erler & Kalinowski, Inc.

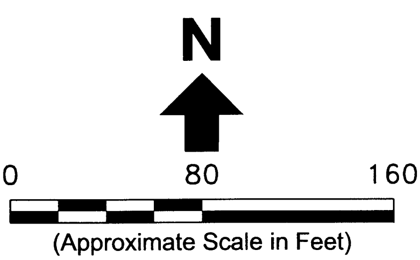
Building 740 Area

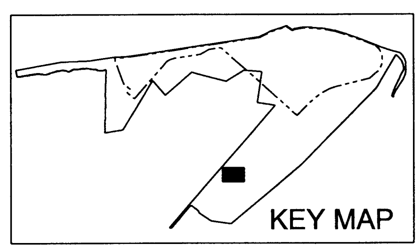
Oakland Army Base
Oakland, CA

September 2002
EKI A10063.00

Figure D-2







EXPLANATION:

Footprint of Former Building or Feature

Monitoring Well

Soil Sample

Erler & Kalinowski, Inc.

Building 650 and 655 Area

Oakland Army Base
Oakland, CA

September 2002
EKI A10063.00

Figure D-3

Notes:

1. All locations are approximate.
2. Basemap taken from IT Corporation "OARB Site Map", dated 17 February 1999.

E

APPENDIX E

Risk Management Plan
(Under Separate Cover)

F

APPENDIX F

Responsiveness Summary

F. RESPONSIVENESS SUMMARY

The Department of Toxic Substances Control (DTSC) issued a public notice on July 22, 2002 to invite the public to comment on the Remedial Action Plan (RAP) and Risk Management Plan (RMP). A public notice and a fact sheet were mailed to approximately 730 individuals, government agencies, and other parties. The public notice was also published on the Oakland Tribune and the San Francisco Chronicle on July 22, 2002 announcing the 30-day public comment period. DTSC held a public meeting on August 6, 2002 at the West Oakland Multipurpose Senior Center to provide information and answer questions about the proposed remedies. The comment period ended on August 21, 2002. DTSC received four written comments and one verbal comment during the public meeting. This Responsiveness Summary contains restatement of the public comments, DTSC's responses, and copies of the actual comment letters and transcripts of verbal comments.

<u>Comments from Mr. William R. Kirkpatrick, East Bay Municipal Utility District, Letter Dated August 12, 2002</u>

Comment 1: *The practice of the District is to not install pipelines or services in soil with contamination levels which would expose workers to dermal or respiratory impacts that cannot be mitigated by Level D personal protective equipment or which would generate soil or groundwater that requires disposal as a hazardous waste. If the District is requested to construct water pipelines and services, wastewater interceptors or pump stations within areas of contamination, depending on the level and type of contamination, the location may not be feasible due to the potential for unacceptable exposure to District personnel when performing installation, repairs, or maintenance.*

Response: Construction activities will be performed within the entire RMP Implementation Area with selected levels of personal protective equipment specified in site-specific health and safety plans that are required by the RMP. The RAP and RMP further require that contamination encountered during repair or replacement of infrastructure including subsurface utilities will be remediated consistent with the remediation goals established in the RAP. Excavated soils will be tested and managed for use on-site or for off-site disposal in accordance with the protocols in the RMP. Responsibilities for remediation and management of waste soils will be retained by the City of Oakland or its designated contractors or agents as provided in its project plans and specifications. Thus, it is envisioned that known or encountered areas of contamination, e.g., where personal protective equipment levels higher than Level D may be required, would be remediated prior to installation or repair of utilities by East Bay Municipal Utility District or that utilities will be placed in suitable corridors established by the City or its designees.

Comments from Ms. Diane Heinze, Port of Oakland, Letter Dated August 21, 2002

Comment 1: *Section 8.3.2 of the RMP requires after the construction of permanent improvements, annual physical inspections of the property to confirm adequate cover so that COC impacted soils are not exposed, groundwater is not being used for any purpose, and to confirm that other requirements of the Land Use Covenant are being followed. The text further states that the covered materials will be inspected for breaches, gaps, breaks, depressions, etc. Descriptions of the observed condition of the covered areas will be noted in the inspection reports, and necessary repairs performed. The Port suggests that the inspection of cover materials be limited to observation of areas where breaks in cover materials result in the exposure of native material, not to document cracks where no exposure exists.*

Response: The text in Section 8.3.2 of the RMP on page 8-4 has been revised to state that the routine inspection of cover materials will be for purposes of identifying areas where exposures to on-site personnel may be greater than assumed in the development of remediation goals in the RAP. Inasmuch as the cover requirements are primarily to preclude direct human contact with the underlying soils, and not to provide an impermeable barrier, the RMP does not intend documentation of minor cracking of cover materials. Cracking that may indicate, or be expected to result in, significant deterioration of cover materials will be identified and repaired in accordance with the RMP.

Comment 2: *Section 2.4 of the RAP specifies that any property that is not being transferred via the Economic Development Conveyance (EDC) is not considered in this RAP/RMP. For clarification, note that any off-site property adjacent to the EDC area which may be contaminated from Army activities in the EDC area is an Army-Retained Condition such as off-site pesticides described in Section 4.4.3.6 of the RAP.*

Response: The Army remains responsible for all contaminants located outside the EDC area, including for example the off-site pesticide wetland remediation area, Parcel 1, and the area near Building 991. The term "Army-Retained Condition" actually refers to certain types of contaminants on the EDC area that, if discovered, remain the responsibility of the Army to remediate in accordance with applicable legal requirements.

Comment 3: *Page 1-1 of the RMP states that the RMP will become an appendix to, and enforceable, as part of, the Land Use Covenant ("LUC"). The RMP should not be an appendix to the LUC (which runs with the land) because changes to the RMP will occur. For example, portions of the RMP that describe sampling of known RMP locations (7.4 Soil Management Protocols), and reporting results to DTSC (5.1.4 Completion Reports) will be excluded from the RMP after DTSC approval of the completion report to eliminate possible future redundant sampling. The RMP should only appear as a citation in the LUC with the understanding that the RMP will be modified over time with DTSC concurrence as already anticipated in the RMP, e.g., see Section 5.2.*

There are assurances outside the deed (and LUC) that future site owners and developers will be aware of, and required to implement, the requirements of the then-current RMP. This assurance is provided by the City of Oakland's permit tracking program via the issuance of building permits.

Response: Agreed. The text on page 1-1 of the RMP has been modified to explain that the RMP, or the most current version of the RMP as it may be amended from time to time with approval of the DTSC, will be cited in the land use covenants as a specified requirement; however, the RMP will not be appended to the land use covenants.

Comment 4: *Section 3.2 of the RAP and 2.1 of the RMP state that: "During the first half of 1900s, the Army Corps of Engineers ("ACE") and Port of Oakland placed over 6.5 million cubic yards ("cy") of dredged sand and imported soil to create the land subsequently acquired by the Army." This is incorrect. The Port of Oakland did not place imported soil as fill. The following provides suggested modified language:*

"Prior to the Army's occupancy of the Oakland Army Base in January 1941, most of the property was partially filled with dredge spoils placed by the Army Corps of Engineers ("ACE"), the City and subsequently the Port of Oakland (Annual Reports of the ACE; City of Oakland, 1918, Lease to the Union Construction Company and W.W. Johnson and H.G. Peake doing business under the firm name and style of Union Construction Company, 4 April; Minor Woodruff, 2000. Pacific Gateway: An Illustrated History of the Port of Oakland). The only land area was around the Union Construction Company's buildings. During 1941, the ACE and the Army (referred to at the time as the S.F. Port of Embarkation) placed over 6.5 million cubic yards ("cy") of dredged sand and imported soil to create the remainder of the land area (Army Port Contractors, 1941, Progress report to August 31, 1941 dated 4 September; Bechtel-McCone-Parsons Corporation, 1941, Plot Plan Oakland Port and General Depot, 22 July; Labarre, R.V., 1941, Report on Foundation Investigation and Studies of Proposed Oakland Port and General Depot for Bechtel-McCone-Parsons Corporation, May-June; Army Port Contractors, 1942, Completion Report; and Rogers, David and Sands Figuers, 1991, Engineering Geologic Site Characterization of the Greater Oakland-Alameda Area, Alameda and San Francisco Counties, California. Final Report to National Science Foundation).

Response: The text in these two sections has been revised in response to the above comment, and the additional reference documents have been added to the RAP and RMP reference lists.

Comments from Ms. Lea Loizos, ARC Ecology, Letter Dated August 21, 2002

Comment 1: *Writing a RAP prior to full characterization of the site is contradictory to the CERCLA process and undermines the quality of the report. Without full characterization of the majority of the RMP sites, the possibility remains for the extent of contamination to be greater than what was originally expected and it is difficult to accept that the proposed remedies will be protective of human health. Relying on base use history as a guide to the remaining contamination in the RMP sites is an insufficient method of characterization.*

Response: Under the National Oil and Hazardous Substances Pollution Contingency Plan, included in both CERCLA and the California Health and Safety Code, Chapter 6.8, characterization of a site is intended to be sufficient so that appropriate remedial actions can be selected. U.S. EPA makes this point clear when its identifies time and cost as the two primary constraints in developing and implementing a sampling strategy to characterize a site under CERCLA. In the *Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A)*, dated December 1989, U.S. EPA states the following:

"In general, it is important to remember when developing the sampling strategy that detailed sampling must be balanced against the time and cost involved. The goal of RI/FS sampling is not exhaustive site characterization, but rather to provide sufficient information to form the basis for site remediation."

Characterization of the OARB, including identification of RAP sites and RMP locations, was developed through a process equivalent to an adequate Preliminary Endangerment Assessment. As such, all sites for which historical records, photographs, interviews with past employees, and preliminary sampling have been identified. DTSC believes that characterization to date is sufficient to select remedies or suites of remedies to be applied to contamination. Further sampling of known sites to aid in design of remedies is contemplated. The RMP further provides for a specific process to be followed in the event that a site is discovered for which no previous evidence existed.

Thus, the RMP provides a level of environmental response action beyond what is typically obtained in cleanup of specific CERCLA sites. The RMP provides protocols for managing redevelopment work in all areas of the base, including areas of no known chemical use history or just suspected potential release locations. All RMP locations as identified in the RMP will be sampled during redevelopment, and protocols obligating the construction contractors to report and manage unknown release locations, if and when encountered, are contained in the RMP.

Comment 2: *More importantly, the RMP only addresses how unknown contamination will be addressed if discovered. There is no mention of who will cover the costs of unexpected remediation. What protections are in place to insure that the contamination will be remediated and not left in place due to lack of funding?*

Response: The City of Oakland is identified as the party responsible for remediation of the OARB through a Consent Agreement with DTSC. The City of Oakland in turn has secured some funding from the Army, has committed the City's funds, and has purchased environmental remediation insurance that will provide funds in the event that new release locations are discovered or the planned remediation, e.g., at identified RAP sites, becomes more costly than now estimated.

Comment 3: *Furthermore, how can it be assumed that contamination will be discovered during redevelopment if no prior sampling is required of the area? It is inappropriate to assume that a visual inspection of soils will identify contamination.*

Response: There is no basis on which to specify sampling points or analytes to consider at locations not already identified as RAP sites or RMP locations. As would typically be the case at a construction site, not otherwise identified as contaminated, visual or olfactory clues serve to suggest that the site requires further evaluation. In addition to visual inspection of soils, the RMP requires that at least two soil samples be collected within ten feet of each RMP location (Section 7.4 of the RMP). The RMP specifies that environmental sampling for a wide range of chemicals of concern will be conducted at all RMP locations as identified in the RMP, unless available data are determined to be adequate.

Comment 4: *Section 2.2.2, page 2-3 of the RMP states that RMP [locations] include former industrial and chemical handling locations with little or no subsurface environmental data. If little or no sampling has been conducted in these areas, how can one be certain that the contamination is minimal?*

Response: Soil and groundwater sampling was conducted at six of the seven "Former Industrial and Chemical Handling Locations" RMP locations during the Army and the Oakland Base Reuse Authority (OBRA) Phase II Investigations in May 2002. The results are summarized in Section 4.4.4.3 in the RAP. The words "with little or no subsurface environmental data" have been deleted in the subject text. See also responses to Comments 1 and 3 above.

Comment 5: *The RMP makes the assumption that buildings, asphalt roadways, concrete pavement, and other cover types existing and planned at OARB may adequately protect human health against contact with petroleum hydrocarbons and other COCs most frequently identified at RMP sites. (Section 1.1, page 1-4) Again, not knowing the full extent of contamination, it is impossible to assume that this type of cover will be protective of all remaining, undiscovered contamination.*

Response: As discussed in the response to Comment 1, much is known about the chemicals of concern ("COCs") at the base. This information has been used in accordance with state and federal guidance to establish risk-based remediation goals and to select appropriate remedies as documented in the RAP. In general, there are few areas on the base with COCs that cannot be contained by simple cover materials. Areas with elevated concentrations of VOCs, for example, are targeted for active remediation as RAP sites. Further, any RMP locations that are determined to be poor candidates for RMP type remedies will be reevaluated for other remedies as defined in the RAP.

Comment 6: *Page 4-2 (40) RMP: The RMP mentions the possibility of contaminated ground water migrating to San Francisco Bay through the gravel or sand beddings that surround storm drains. This potential problem is not mentioned anywhere else in the document.*

Response: The comment relates to a potential condition, not one that is now documented to be occurring. Section 10.2.2.7 of the RAP describes the selected remedial alternative for storm drains and sanitary sewers. Remediation of contaminated media near storm drains and sewers in accordance with the remediation goals established in the RAP is required. Removing contaminated soil when found along existing storm drains and sanitary sewers, as well as other RMP locations, will serve to remediate localized impacts to groundwater by eliminating possible sources of COCs to the shallow water-bearing zone. Further, as stated in Section 6.1.1 of RMP, repair and replacement of subsurface utilities will incorporate design features such as grout collars and the like, where necessary.

Comment 7: *Who will pay for the costs of implementing the required engineering controls and routine groundwater monitoring discussed in Section 7 of the RMP?*

Response: The City of Oakland is obligated under the Consent Agreement to ensure implementation of applicable long-term maintenance and monitoring requirements of the RMP.

Comment 8: *Rather, it should be assumed that all previously unsampled RMP sites are contaminated until proven otherwise. Sampling should be required at all RMP sites before redevelopment activities begin.*

Response: See response to Comment 1. Most RMP locations were sampled during the Army's various remedial investigations or the Army's and OBRA's Phase II Investigations in May 2002. Tables 1 and 2 in the RMP summarize the investigations at each RMP location and have been updated to reflect which locations were investigated during the Army and OBRA Phase II environmental sampling activities.

Comments from Ms. Louise J. Belle, Letter Dated August 3, 2002

Comment 1: *I think it is a waste of energy, plastic, and other resources to send out CDs unless specifically on request.*

Response: The CD was used in an effort to minimize the volume of paper and number of binders that would be required to provide the public with copies of the environmental data. Access to the data is necessary for many reviewers of the documents. Without use of the CD, a huge amount of paper would have been needed. In the future, the CDs will be provided to selected agencies and parties. The CDs will also be sent to individuals whom have requested copies.

Comments from Ms. Elaine Wyrick-Parkinson during Public Meeting on August 6, 2002
(Summarized Generally from Public Meeting Transcript)

Comment 1: *Why did the Army only recently find that Building 1 was toxic? The "ooze" was known about a long time ago.*

Response: The concerns about the characteristics and need for remediation of the tarry residue beneath and near Building 1 have evolved over the past few years as additional information has been obtained from observations of the "ooze", reviews of records and historical aerial photographs, and completion of subsurface environmental investigations in areas where access is possible. This information is summarized below.

According to Army's records, the Army constructed Building 1 in 1941 during the early stages of World War II when the OARB began operations. An oil reclaiming plant ("ORP") reportedly operated on the site from the 1920s through the 1930s. The Army removed the aboveground ORP facilities prior to constructing Building 1.

At the time of the operation of the former ORP, tidal mudflats were present immediately to the north and northwest beyond a bulkhead. From historical aerial photographs, the area of staining indicates that the waste from the ORP was likely deposited onto the mudflats (1939 aerial photograph from University of California at Berkeley Photo Archives and 1941 aerial photograph, Army records). This area was later covered by dredged fill and dry fill during the construction of the Army facilities in 1941 and 1942; however, a thick, tarry layer under this fill area remains (*Draft Feasibility Study for Operable Unit 1, Oakland Army Base, Oakland*, California, Revision B, dated 26 January 2001 ("Draft Feasibility Study") at pp.1-6 to 1-7).

Building 1, made up of four wings, was built on the filled land just north of the former ORP and is supported by green wooden pilings, driven 45 to 70 feet deep. The pilings would have penetrated the fill, the tarry layer, and mud, finally stopping in the underlying Merritt Sand layer. Creosoted pilings, approximately 20 feet long, were attached to the top of the green pilings, and these in turn support the main beams in the building crawl space (Draft Feasibility Study at p.1-7).

In the Army's Draft Feasibility Study, IT Corporation indicates that early oil recycling processes included the addition of concentrated sulfuric acid to the oil as a pretreatment step. The sulfuric acid would act as an oxidizer to remove unsaturated hydrocarbons, sulfur, nitrogen and oxygen compounds as well as resinous and asphaltic compounds. The separated oil would then undergo distillation or fractionation to produce the useful components such as various oils. The residuals from this process would consist of a heavy mixture of undistillable hydrocarbons and sulfuric acid sludge left in the bottom of the tanks. The waste was too acidic and unprofitable to neutralize. Therefore, it is likely that it was simply dumped on-site, as there were no environmental laws prohibiting such actions at the time (Draft Feasibility Study at pp.1-6 to 1-7).

The thick, tarry residue, sometimes referred to as "ooze," has been observed on several occasions to surface in and around Building 1. In 1994, the Army removed and replaced a section of pavement in the eastern parking lot between Wings 1 and 2, where buckled asphalt and a tar-like substance were observed. In 1998, the Army excavated a broader area in the same parking lot to remove a tar-like substance. The excavation continued toward Wing 2 of the building, but excavation efforts ceased approximately 15 feet from the building foundation due to utility and structural concerns.

In 2000, the Army found a tarry substance extruding through the joints of the sanitary sewer line during a video camera examination of the pipes. The presence of the tarry material prevented examination beyond 80 feet due to slipping drive wheels on the video camera. Also in 2000, City of Oakland employees discovered a tar-like substance in the crawl space of Wing 1, some 120 feet to the southeast of the previous parking lot excavation. The substance was extruding from the subsurface through a small gap between the wooden piling and the concrete vermin-protection slab. The substance had a black skin that was stiff and slightly resilient, appearing to be an oxidized layer over a softer interior. When the outer layer was penetrated, a clear watery liquid welled up and squirted out as if under pressure. The liquid reacted with the concrete slab, producing a faint hissing and bubbling. A test with pH paper indicated a very strong acid and faint traces of sulfurous and nitrous gases were noticed (Draft Feasibility Study at p.1-7).

As recently as March 2002, Army investigators again found that the tarry material had surfaced in the crawl space of Building 1 at a piling.

Laboratory analysis of the oily residue has confirmed its acidic nature. Lead has been measured at a concentration as high as 11,800 mg/kg in the oily residue.

The material also contains polycyclic aromatic hydrocarbons ("PAHs"), polychlorinated biphenyls ("PCBs"), polychlorinated dibenzodioxins ("PCDDs"), and polychlorinated dibenzofurans ("PCDFs") at concentrations of concern. PAHs were the contaminants in the tarry residue that contributed to the Army's finding of an unacceptable human health hazard requiring remediation (Draft Feasibility Study at pp. 1-8, 2-9 to 2-10). Available laboratory analytical results indicate, at a minimum, that the tarry material when excavated or removed would probably meet the State of California and Federal definitions of a hazardous waste.

The Army noted that the presence of the ooze in the crawl space of Building 1 indicates that changes can and are occurring in the subsurface under Building 1. Analysis confirmed that free liquid present within the ooze exhibits a pH of 1, likely due to pockets of sulfuric acid. In its draft Feasibility Study in January 2001, the Army concluded that remediation of contaminants in the soil at the former ORP area, including under and around Building 1, is warranted due to its potential mobility and the unacceptable health risks from exposure to the tarry residue (Draft Feasibility Study at p. 2-9). Similarly, the RAP identifies the ORP/Building 1 area as one of seven RAP Sites planned for active remediation in advance of any redevelopment activities.

Comment 2: *Building 1 can be saved if we want to save it.*

Response: Tarry residue beneath Building 1 cannot be removed with the structure present. To provide sufficient clearance for excavators and other heavy equipment to access the tarry residue, Building 1 must be demolished because it is not feasible to relocate it. Building 1 is a large, multi-winged structure, and Wings 1 and 2 of Building 1 comprise approximately one-half of the building, or about 80,000 square feet. Temporary relocation of Building 1 during remediation would involve separating Wings 1 and 2 and utilities from the remaining wings, stabilizing both segments, placing the structure to be removed on a dolly, raising the structure, and cutting the existing wood pilings after the building has been lifted. After remediation (which would involve excavation with heavy equipment), new pilings would be constructed and the building would be returned to the site and reconnected. The Army concluded that based on the "inherent risk and uncertainties involved with the temporary relocation of Wings 1 and 2, demolition, was selected" (see pages 2-12 through 2-13 of Draft Feasibility Study). This conclusion is also consistent with the findings in the Draft Historic Building Reuse Alternatives Report, which concludes; "Building 1, though modular in plan, was considered excessively large to consider relocating. Additionally, its historic significance and prominence on the Base would be compromised by relocation. For these reasons, relocation of Building 1 has not been included in the cost estimates presented in this report".

Public Comments

1. Mr. William R. Kirkpatrick
   East Bay Municipal Utility District, Letter Dated August 12, 2002

2. Ms. Diane Heinze
   Port of Oakland, Letter Dated August 21, 2002

3. Ms. Lea Loizos
   ARC Ecology, Letter Dated August 21, 2002

4. Ms. Louise J. Belle
   Community Member, Letter Dated August 3, 2002

5. Ms. Elaine Wyrick-Parkinson
   Community Member, Verbal Comments during Public Meeting on August 6, 2002

EAST BAY
MUNICIPAL UTILITY DISTRICT

August 15, 2002

Mr. Henry Wong, Remedial Project Manager
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94112

Dear Mr. Wong:

Re: Draft Remedial Action Plan/Draft Risk Management Plan - Oakland Army Base, Oakland

East Bay Municipal Utility District (District) appreciates the opportunity to comment on the Draft Remedial Action Plan/Draft Risk Management Plan for Oakland Army Base. The District has the following comments regarding water and wastewater services at the project site.

The subject document discusses at length the presence of a variety of contaminants in the soil and the groundwater, each with various levels of contamination depending upon location. The District is concerned about the presence of heavy metals, particularly lead from old paint on the buildings, volatile organics, solvents, MBTE, and Benzene.

The practice of the District is to not install pipelines or services in soil with contamination levels which would expose workers to dermal or respiratory impacts that cannot be mitigated by Level D personal protective equipment or which would generate soil or groundwater that requires disposal as a hazardous waste. If the District is requested to construct water pipelines and services, wastewater interceptors or pump stations within areas of contamination, depending on the level and type of contamination, the location may not be feasible due to the potential for unacceptable exposure to District personnel when performing installation, repairs, or maintenance.

If you have any questions or if the District can be of further assistance, please contact Marie A. Valmores, Senior Civil Engineer, Water Service Planning, at (510) 287-1084.

Sincerely,

WILLIAM R. KIRKPATRICK
Manager of Water Distribution Planning

WRK:WWMcG:sb
sb02_288.doc

cc: Ms. Aliza Gallo, Executive Director

PORT OF OAKLAND

August 21, 2002

Mr. Henry Wong
Remedial Project Manager
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94112

Subject : Oakland Army Base – Port of Oakland's Comments on the Draft Remedial Action Plan/Risk Management Plan

Dear Henry:

This letter contains the Port of Oakland's (Port) comments on the "Draft Remedial Action Plan" and "Draft Risk Management Plan" ("RAP/RMP") dated 19 July 2002 prepared by Erler & Kalinoswki, Inc., for the Oakland Base Reuse Authority ("OBRA") and the Department of Toxic Substances Control ("DTSC"). As a future Site Owner and Developer of the Port Development Area ("PDA") as documented in OBRA's Final Reuse Plan, the Port trusts you will consider the following comments when preparing and approving the final RAP/RMP.

1. Section 8.3.2 Periodic Inspection of Site Capping Materials

This section requires after the construction of permanent improvements, annual physical inspections of the property to confirm adequate cover so that COC impacted soils are not exposed, groundwater is not being used for any purpose, and to confirm that other requirements of the Land Use Covenant are being followed. The text further states that the covered materials will be inspected for breaches, gaps, breaks, depressions, etc. Descriptions of the observed condition of the covered areas will be noted in the inspection reports, and necessary repairs performed. The Port suggests that the inspection of cover materials be limited to observation of areas where breaks in cover materials result in the exposure of native material, not to document cracks where no exposure exists.

2. Off-site Contamination

Section 2.4 of the RAP specifies that any property that is not being transferred via the EDC is not considered in this RAP/RMP. For clarification, note that any off-site property adjacent to the EDC area which may be contaminated from Army activities in the EDC area is an Army Retained Condition such as off-site pesticides described in Section 4.4.3.6 of the RAP.

530 Water Street ▪ Jack London Square ▪ P.O. Box 2064 ▪ Oakland, California 94604-2064
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3. Request for Elimination of the RMP as an Appendix to the Land Use Covenant

Page 1-1 of the RMP states that the RMP will become an appendix to, and enforceable, as part of, the Land Use Covenant ("LUC"). The RMP should not be an appendix to the LUC (which runs with the land) because changes to the RMP will occur. For example, portions of the RMP that describe sampling of known RMP locations (7.4 Soil Management Protocols), and reporting results to DTSC (5.1.4 Completion Reports) will be excluded from the RMP after DTSC approval of the completion report to eliminate possible future redundant sampling. The RMP should only appear as a citation in the LUC with the understanding that the RMP will be modified over time with DTSC concurrence as already anticipated in the RMP, e.g., see Section 5.2.

There are assurances outside the deed (and LUC) that future site owners and developers will be aware of, and required to implement, the requirements of the then-current RMP. This assurance is provided by the City of Oakland's permit tracking program via the issuance of building permits.

4. Placement of Imported Soil as Fill

Section 3.2 of the RAP and 2.1 of the RMP state that: "During the first half of 1900s, the Army Corps of Engineers ("ACE") and Port of Oakland placed over 6.5 million cubic yards ("cy") of dredged sand and imported soil to create the land subsequently acquired by the Army." This is incorrect. The Port of Oakland did not place imported soil as fill. The following provides suggested modified language:

> "Prior to the Army's occupancy of the Oakland Army Base in January 1941, most of the property was partially filled with dredge spoils placed by the Army Corps of Engineers (" ACE"), the City and subsequently the Port of Oakland (Annual Reports of the ACE; City of Oakland, 1918, Lease to the Union Construction Company and W.W. Johnson and H.G. Peake doing business under the firm name and style of Union Construction Company, 4 April; Minor Woodruff, 2000. Pacific Gateway: An Illustrated History of the Port of Oakland). The only land area was around the Union Construction Company's buildings. During 1941, the ACE and the Army (referred to at the time as the S.F. Port of Embarkation) placed over 6.5 million cubic yards ("cy") of dredged sand and imported soil to create the remainder of the land area (Army Port Contractors, 1941, Progress report to August 31, 1941 dated 4 September; Betchtel-McCone-Parsons Corporation, 1941, Plot Plan Oakland Port and General Depot, 22 July; Labarre, R.V., 1941, Report on Foundation Investigation and Studies of Proposed Oakland Port and General Depot for Bechtel-McCone-Parsons Corporation, May-June; Army Port Contractors, 1942, Completion Report; and Rogers, David and Sands Figuers, 1991, Engineering Geologic Site Characterization of the Greater Oakland-Alameda Area, Alameda and San Francisco Couties, California. Final Report to National Science Foundation).

If you have any questions, please contact me at 510-627-1467.

Sincerely,

Diane Heinze, P.E.
Associate Port Environmental Scientist

Cc : Michele Heffes, Port of Oakland
Jon Amdur, Port of Oakland
Roger Caswell, OARB
Joshua Bloom, Bingham McCutcheon
Yane Nordhav, BASELINE
Tom Kalinowski, EKI
Jennifer Hernandez, Beveridge & Diamond

Arc Ecology

Environment, Economy, Society, & Peace

August 21, 2002

Henry Wong
Remedial Project Manager
Department of Toxic Substances Control
700 Heinz Ave., Suite 200
Berkeley, CA 94112

BY FAX: 510-849-5285

RE: Draft Remedial Action Plan (RAP)/Risk Management Plan (RMP) for Oakland Army Base, Oakland, CA

Dear Mr. Wong:

Arc Ecology has reviewed the above-mentioned document. I am pleased to see that active remediation has been chosen for all of the RAP sites. I am, however, concerned with the assumptions being made in the RAP/RMP about sites that have yet to be fully characterized. Writing a RAP prior to full characterization of the site is contradictory to the CERCLA process and undermines the quality of the report.

Without full characterization of the majority of the RMP sites, the possibility remains for the extent of contamination to be greater than what was originally expected and it is difficult to accept that the proposed remedies will be protective of human health. Relying on base use history as a guide to the remaining contamination in the RMP sites in an insufficient method of characterization.

More importantly, the RMP only addresses how unknown contamination will be addressed if discovered. There is no mention of who will cover the costs of unexpected remediation. What protections are in place to insure that the contamination will be remediated and not left in place due to a lack of funding? Furthermore, how can it be assumed that contamination will be discovered during redevelopment if no prior sampling is required of the area? It is inappropriate to assume that a visual inspection of soils will identify contamination.

Specifically:

- Section 2.2.2, page 2-3 of the RMP states that RMP include former industrial and chemical handling locations with little or no subsurface environmental data. If little or no sampling has been conducted in these areas, how can one be certain that the contamination is minimal?

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San Francisco, California 94103, United States of America
PHONE: 415.495.1786 | *FAX:* 415.495.1787 | *EMAIL:* arc@igc.org

- The RMP makes the assumption that buildings, asphalt roadways, concrete pavement, and other cover types existing and planned at OARB **may** adequately protect human health against contact with petroleum hydrocarbons and other COCs most frequently identified at RMP sites. (Section 1.1, page 1-4) Again, not knowing the full extent of contamination, it is impossible to assume that this type of cover will be protective of all remaining, undiscovered contamination.

- Page 4-2 (40) RMP: The RMP mentions the possibility of contaminated ground water migrating to San Francisco Bay through the gravel or sand beddings that surround storm drains. This potential problem is not mentioned anywhere else in the document.

- Who will pay for the costs of implementing the required engineering controls and routine groundwater monitoring discussed in Section 7 of the RMP?

In order to create remedies that are truly protective of human health, it is preferred that further characterization of the site be completed prior to redevelopment of OARB. Given my experience at other military installations, it is dangerous to make assumptions about undiscovered contamination. Rather, it should be assumed that all previously unsampled RMP sites are contaminated until proven otherwise. Sampling should be required at all RMP sites before redevelopment activities begin.

I appreciate the opportunity to review this document. If you have any questions, please contact me at 415-495-1786.

Sincerely,

Lea Loizos
Staff Scientist

Louise J. Belle

08/03/02

To DTSC - California EPA:

Thank you for the materials on the Oakland Army Base reuse proposal. - But one thing I do not need is the CD. I think it is a waste of energy, plastic, & other resources & materials to send out CDs unless specifically on request.

Please send the CD (enclosed) to someone else, or reuse/recycle it. (You could also package the CDs in paper sleeves instead of hard plastic.)

Thank you,

L. Belle

L. Belle
P.O. Box 5271
Berkeley, CA 94705

PUBLIC MEETING

STATE OF CALIFORNIA

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

OAKLAND ARMY BASE

DRAFT REMEDIAL ACTION PLAN

RISK MANAGEMENT PLAN

WEST OAKLAND MULTIPURPOSE SENIOR CENTER

1724 ADELINE STREET, SECOND FLOOR

OAKLAND, CALIFORNIA

TUESDAY, AUGUST 6, 2002
6:30 P.M.

Reported by:
Peter Petty

ORIGINAL

PETERS SHORTHAND REPORTING CORPORATION
3336 BRADSHAW ROAD, SUITE 240, SACRAMENTO, CA 95827 / (916) 362-2345

Comments from Ms. Wyrick-Parkinson during the public meeting on 8/6/02

Base. And consistent with Mike's first RAP site, Building 1 Oil Reprocessing Plant residue, the Army has applied for a Land Disposal Restriction variance from USEPA, so that the material can be stabilized onsite and then buried in a California landfill. This meets protection of the environment, an effective use, and a cost effective way to do it.

There are -- I brought a notice along, a public notice, which will be mailed out in a general mailing shortly, that sketches the LDR variance process and what we're intending to apply it to.

Thank you.

PUBLIC PARTICIPATION SPECIALIST RYAN: Thank you very much.

At this point we'd like to open the floor, open the meeting to questions from -- we have representatives from the Army, from the Department of Toxic Substances Control, from EKI, and from OBRA, present, who can answer questions relative to the presentations that just were presented, or any other questions you may have regarding the Oakland Army Base.

So is there anyone who would like to have a question at this time?

MS. WYRICK-PARKINSON: I'm late coming, I know. I have a million, but that's all right. I need to look at the materials first. Thank you.

Where are you on the agenda?

PUBLIC PARTICIPATION SPECIALIST RYAN: We are just about at the Formal Comment period, which will be Number 4.

MS. WYRICK-PARKINSON: Oh, you're all over. So I can't ask any questions.

PUBLIC PARTICIPATION SPECIALIST RYAN: Yes, you can. That's -- this is your opportunity to ask any questions, if you'd like, prior to the comment segment of the meeting.

MS. WYRICK-PARKINSON: Yeah. Well, can I -- through the Chair, I'd like to address -- one of the things I was concerned about was I -- oh, yes. My name is Elaine Wyrick-Parkinson, and I am with the -- as well as the RAP.

And I, in the comments, I notice where Mr. Rogers had written a letter, and in the letter he said how poisonous Building 1 was. And I wonder why he didn't mention all the other things that's supposed to be left out there at the Army base that's still there. And that was a concern of mine.

And the other concern that we have worked, I started working on the RAP with Mr. Keller, and that was one of the cleanest spots on the Army base, was Building 1. And here, when we get way down the road, Building 1 is so poisonous until you can't even go near it, and I just can't imagine how Mr. Caswell could write such a letter, because I was really surprised to read it. And because we had said that we knew when Mr. Keller was there, there was a ooze in the back of the building. And we had wondered where it came from. They had done a lot of research on it, so they say. And so now I'm wondering about what did the RAP really do. What did we really do out there?

It seems like to me that we spent millions of dollars, and we didn't do what we were supposed to do, because I can't see in the last couple of months that a building could become so poisonous where people have worked there for years, and there are no symptoms. And I just wonder and question the letter. And I guess I always will, because working on the RAP and going to the Army base, at one time I went to the Army base once every month to meet with the environmentalists. And each one said that that building was one of the cleanest building, except for I think -- well, they said it was very little lead, very little asbestos at that particular building. So it was almost toxic free.

And I just can't imagine overnight that these things happened. And I question what did we really do. Now, when I say we, I mean the RAP, what did we really clean up at the Army base. I bet if we went out there and started all over again with new environmental people, we would find either it's -- it's, what is that, leaking clean, whatever that little saying is, or it's filthy. One or the other. And so, because it's, you know, the building became hot when the port decided they wanted the other side of the Army base. Then this building began to be questioned, and little by little we were finding things wrong with it. And then all of a sudden, it exploded, and we found everything wrong with it. It's the dirtiest building on the entire Army base.

And I find that very questionable. And so, you know, I really plan to write some letters to find out, or do some calling to find out what is really wrong with that building, because I just can't believe it. And so -- and I know, I have worked, and I know what you do as an employee. I know those kind of things, they become very political. And being political, things do happen.

And so -- and the rest of the Army base, it's all in question because we spent so many years and the community came out on the short end of the stick. And so I guess that's why very few of us are sitting at the table today, due to the fact, or even in the audience, of us coming out on the short end of the stick. And so I still say we can save Building 1 if we want to, because there isn't anything you can't save, just like the two little girls they separated their little heads today. Took them 20 hours, but they're still breathing. So you can do anything you want to do. All you have to do is set your mind for it, and go ahead and do it.

We talk about money, but money was here when many years ago they had some means of money, or exchange. So it can be done, and we can find money. There's grants and everything to save historical buildings. And so we realize this, but we've gone along with the story, and it has been a very interesting story and a very educational story, for me.

Thank you.

PUBLIC PARTICIPATION SPECIALIST RYAN: Would you like a response from the Army?

MS. WYRICK-PARKINSON: There's no response. I already know what it is. So I don't need one, because I'm on the RAP. And I was at the meeting Thursday night, so I know what the answer is. It can't be any different, because Thursday night was the hearing downtown. So if it has changed, I'm sure downtown would be very interested in the change. So I don't need an answer.

PUBLIC PARTICIPATION SPECIALIST RYAN: Is there anyone else who would like to pose a question or comment to the panel at this time, before we actually solicit formal comment?

If not, then we would like to invite you to present any formal comments you might have for the record regarding the presentation you heard tonight. If there is any, you could please present them at this time.

Well, apparently there is not. Again, this is the opportunity to have your comments on the record, and they would be responded to in writing. So once more, I'd like to ask if there is anyone present who would like to do this at this time.

If not, our meeting would be adjourned. Thank you very much for attending.

(Thereupon, the public meeting was concluded at 7:04 p.m.)

-oOo-